C3342

Log Data Report

Borehole Information:

Borehole: C3342			Site: 216-B-38		
Coordinates		GWL[1] (ft):	N/A[2]	GWL Date:	
North	East	Drill Date	TOC[3] Elevation	Total Depth (ft)	Type
N/A	N/A	June 2001	N/A	60	push

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
steel threaded	0.5	6.625	5.625	0.5	0	59.5

Borehole Notes:

This is a temporary borehole pushed to a depth of approximately 60 ft. There is a gravel pad approximately 1 ft thick, and the top of casing sticks up approximately 0.5 ft above the gravel surface.

Logging Equipment Information:

Logging System:	Gamma 2B		Type: SGLS (35%)
Calibration Date:	09/00	Calibration Reference:	GJO-2001-245-TAR
		Logging Procedure:	MAC-HGLP 1.6.5

Logging System:	NMLS		Type: NMLS (Moisture)
Calibration Date:	05/01	Calibration Reference:	GJO-2001-247-TAR
		Logging Procedure:	MAC-HGLP 1.6.5

Logging System:	Gamma 1C		Type: HRLS
Calibration Date:	09/00	Calibration Reference:	GJO-2001-244-TAR
		Logging Procedure:	MAC-HGLP 1.6.5

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	5 (repeat)
Date	7/09/01	7/09/01	7/09/01	7/09/01	7/09/01
Logging Engineer	Spatz/Musial	Spatz/Musial	Spatz/Musial	Spatz/Musial	Spatz/Musial
Start Depth	59.5	34.0	29.5	14.0	14.0
Finish Depth	33.0	28.5	13.0	1.0	8.0
Count Time (sec)	180	180	30	180	180
Live/Real	L	R	R	L	L
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	0.5	0.5	0.5	0.5	0.5
ft/min	n/a[4]	n/a	n/a	n/a	n/a
Pre-Verification	B0015CAB	B0015CAB	B0015CAB	B0015CAB	B0015CAB
Start File	B0015000	B0015054	B0015066	B0015100	B0015127
Finish File	B0015053	B0015065	B0015099	B0015126	B0015139
Post-Verification	B0015CAA	B0015CAA	B0015CAA	B0015CAA	B0015CAA

High Rate Logging System (HRLS) Log Run Information:

Log Run	6				
Date	7/20/01				
Logging Engineer	Pearson				
Start Depth	13.5				
Finish Depth	35.0				
Count Time (sec)	300				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	0.5				
ft/min	n/a				
Pre-Verification	D0000CAB				
Start File	D0002000				
Finish File	D0002043				
Post-Verification	D0002CAA				

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	7				
Date	7/20/01				
Logging Engineer	Spatz/Musial				
Start Depth	0.0				
Finish Depth	59.5				
Count Time (sec)	n/a				
Live/Real	n/a				
Shield (Y/N)	N				
MSA Interval (ft)	0.25				
ft/min	1.0				
Pre-Verification	C0002CAB				
Start File	C0002000				
Finish File	C0062238				
Post-Verification					

Logging Operation Notes:

The zero reference point for all log data is the top of casing. Depths have been adjusted to ground surface, which is taken as the top of the gravel pad. Multiple SGLS log runs were made to adjust count times in response to high dead time intervals. Measurement mode was switched from live time to real time in intervals with high count rates to expedite logging operations. In areas of excessive dead time, the count time was reduced to 30 seconds to provide a log record where spectra were not anticipated to contain reliable full energy peaks. Fine-gain adjustments were made in run 1 after B0015031 (44.0 ft), and in run 4 after B0015103 (12.5 ft).

Analysis Notes:

Analyst:	McCain	**Date:**	07/27/01	**Reference:**	MAC-VZCP 1.7.9, Rev. 2

Pre-run and post-run verification spectra were evaluated and found to be within acceptance criteria. Individual spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with EXCEL. Corrections were applied for casing thickness and dead time. Water correction was not required. Where SGLS dead time exceeds about 40 percent, pulse pileup and peak spreading effects may result in underestimation of peak count rates. The ^{214}Bi peak at 1764 keV was used to determine ^{238}U concentrations instead of the ^{214}Bi peak at 609 keV to avoid interference from the ^{137}Cs peak at 662 keV.

The high rate data were processed for ^{137}Cs count rate at 662-keV energy level using APTEC supervisor. Concentrations were calculated in EXCEL. A casing correction factor of 1.37 was applied to the high rate data to account for the increased attenuation in the 0.5-inch steel casing, relative to 0.28-inch casing, for which the system was calibrated. No shield corrections were required.

The neutron moisture log was processed using the calibration relationship developed for a 6-inch-diameter borehole with 0.28-inch-thick casing. A correction factor of 1.20 was applied to account for the effects of the thicker casing, which is based on an equivalent casing correction for 8-inch-diameter casing developed by Randall.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, and associated decay progeny of ^{232}Th and ^{238}U), man-made radionuclides, and moisture content. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing and water corrections. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. Intervals where SGLS dead time exceeds 40 percent are shaded. The total gamma log is plotted at both logarithmic and linear scales. The logarithmic scale shows the full range of variation, while the linear scale shows subtle variation in low count intervals.

A repeat log plot is also shown. The repeat plot indicates good agreement between successive log runs. This demonstrates good repeatability in both depth and radionuclide measurement.

Results and Interpretations:

^{137}Cs and ^{60}Co were detected. The greatest ^{137}Cs concentration occurs between 13 and 33.5 ft. High dead times and detector saturation occur between 14.5 and 29 ft. The maximum measured ^{137}Cs concentration is about 195,000 pCi/g at 16.5 ft. Between 17.5 and 28.5 ft, the ^{137}Cs concentration falls between 20,000 and

100,000 pCi/g. From 33.5 ft to TD at 59.5 ft the ^{137}Cs concentration gradually decreases from more than 2,000 pCi/g to about 15 pCi/g.

^{60}Co was detected intermittently between 34 and 42 ft, with a maximum concentration of 0.29 pCi/g at 34 ft.

The neutron moisture log indicates a slightly higher moisture content corresponding with the interval of high ^{137}Cs, but it is not clear if this is related to higher moisture content, or to interference from the high gamma flux. There is a relatively thin interval from about 26.5 to 28.5 ft where the moisture content increases from about 5 percent to 8 percent. This zone occurs near the bottom of the interval of maximum contamination, and does not appear to be related to changes in gamma intensity. There is also a zone of elevated moisture content at about 1 to 5 ft with a maximum of 5.5 percent at 3 ft.

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[1] GWL – groundwater level
[2] N/A – not available
[3] TOC – top of casing
[4] n/a – not applicable

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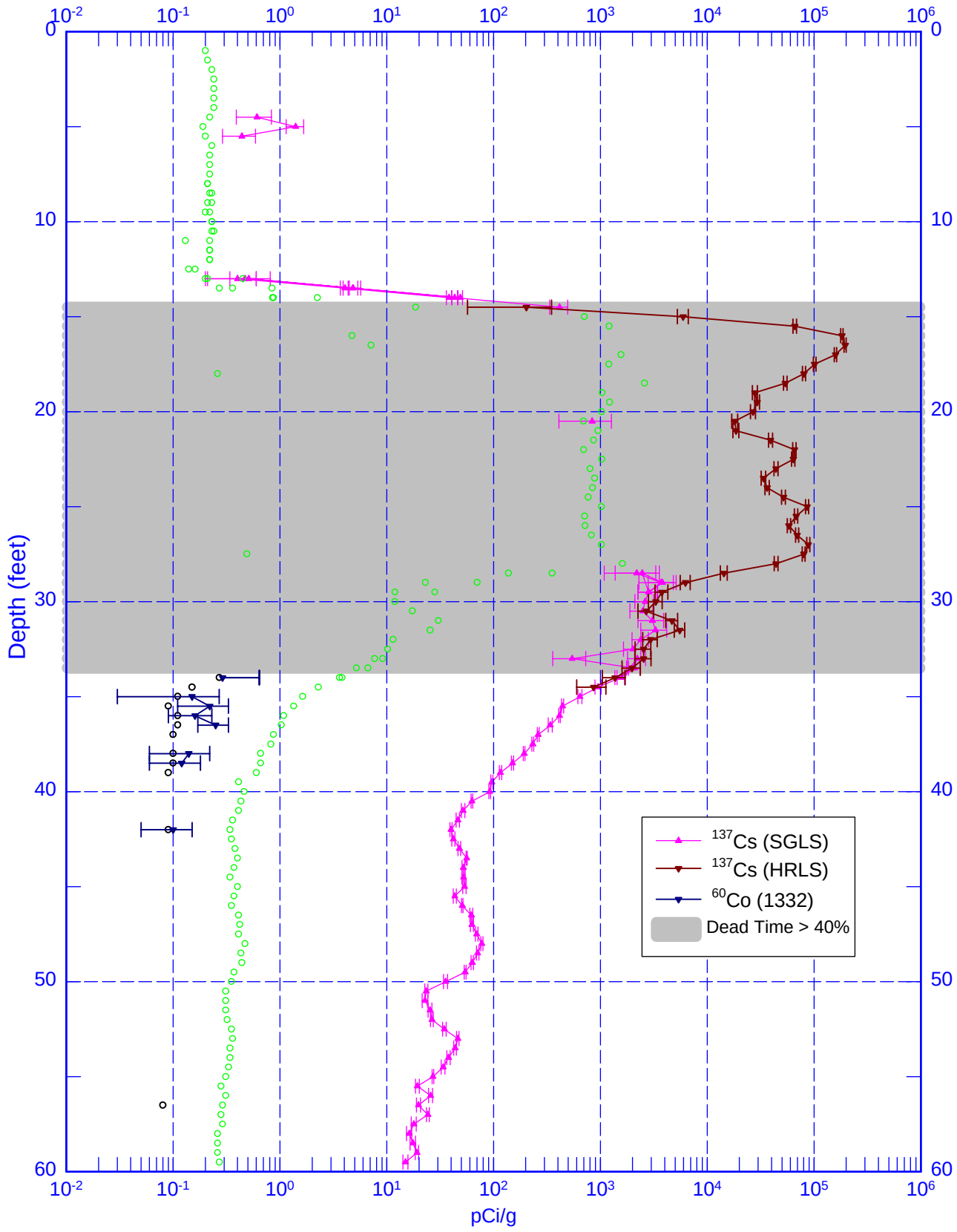
Man-Made Radionuclides

^{137}Cs (662 keV)



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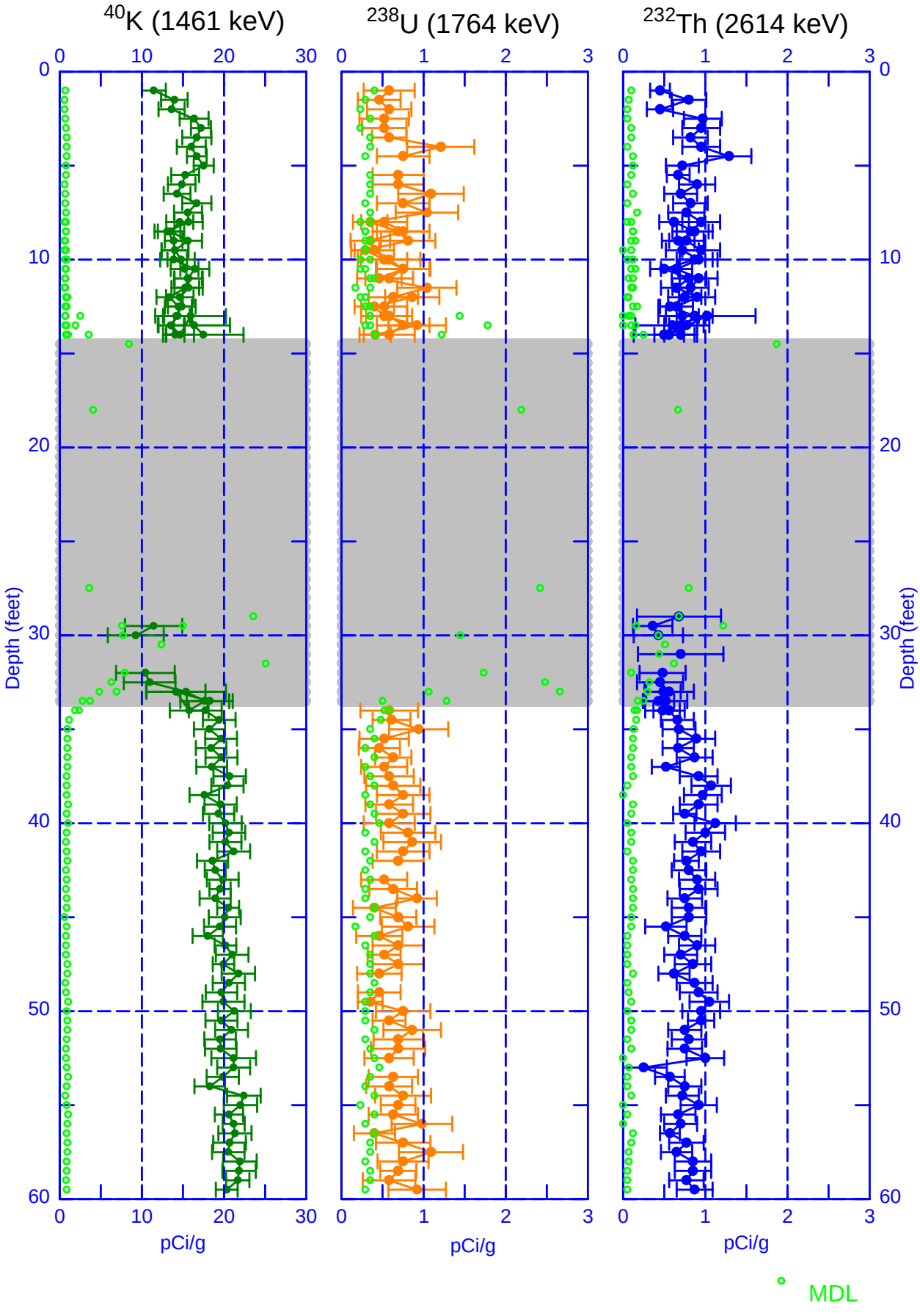
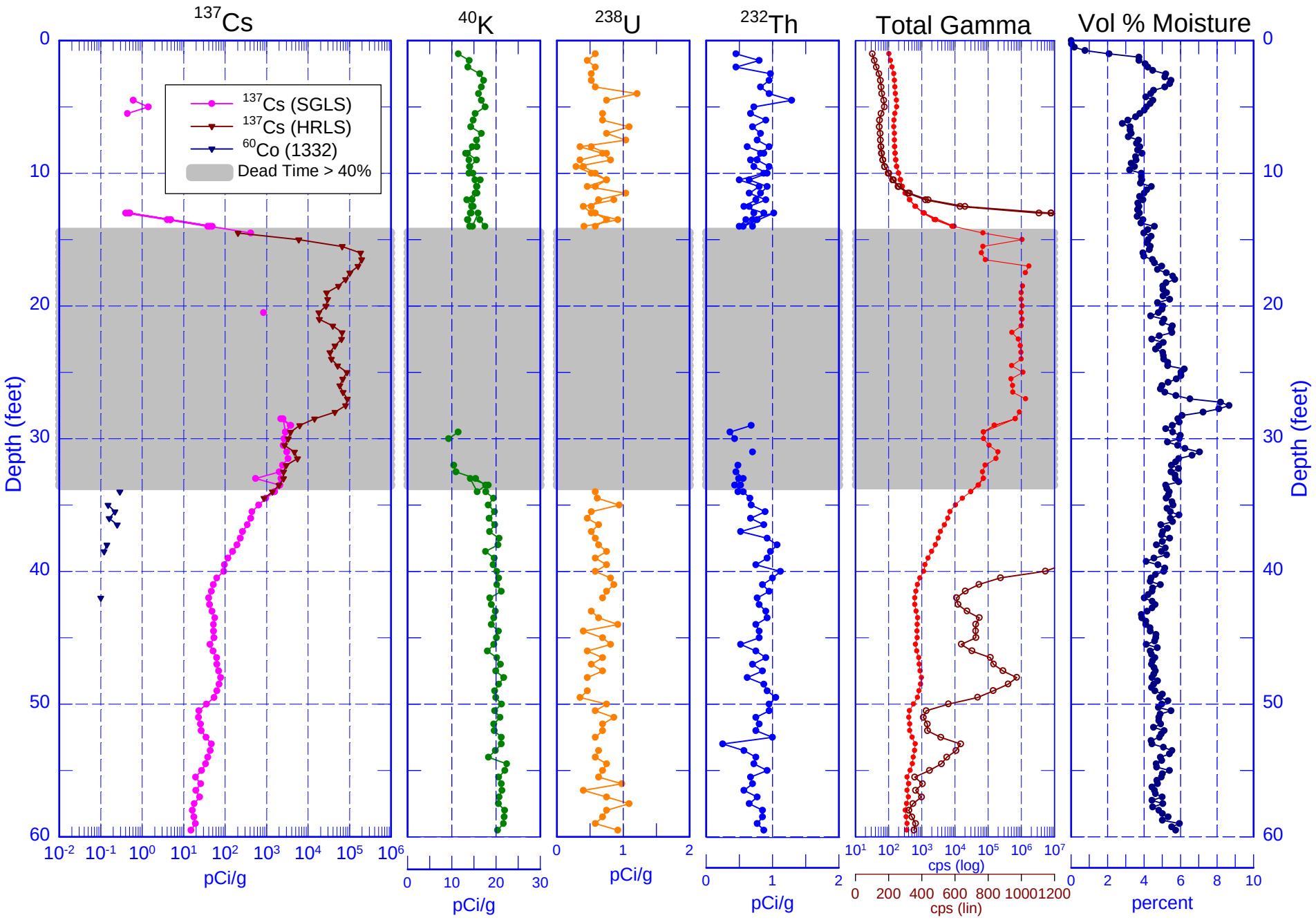
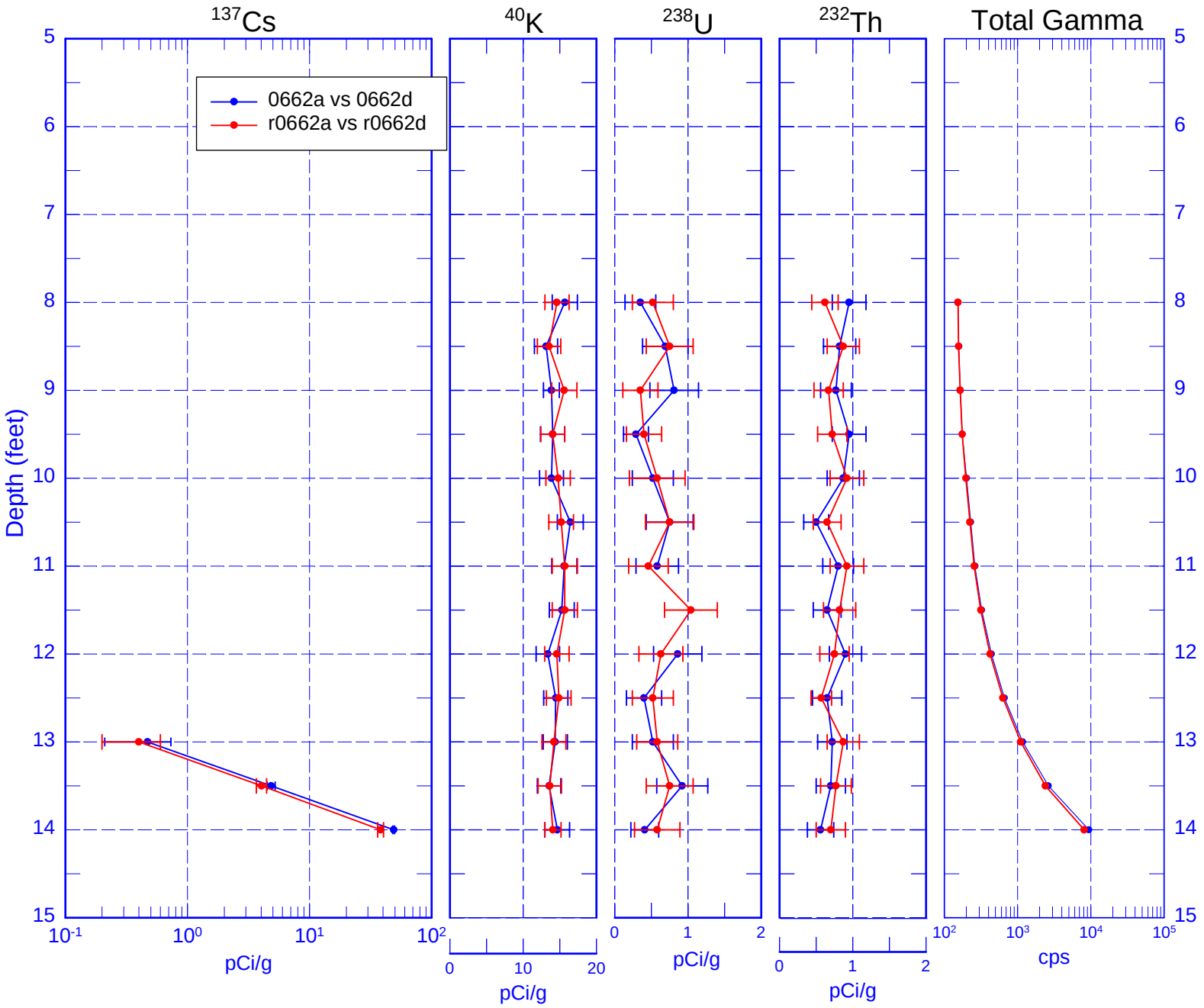
Natural Gamma (KUT) Logs



C3342 Combination Plots



C3342 Repeat Plots



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Total Gamma and Dead Time